

BIOLOGICAL EVALUATION
BLACK PINE-LEAF SCALE IN JEFFREY PINE
GENOA, NEVADA
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INTRODUCTION

The black pine-leaf scale, Aspidiotus californicus Coleman is epidemic on Jeffrey pine in Genoa, Nevada. The infestation was detected by Nevada Division of Forestry personnel in 1973 and aerially mapped by Region 4 entomologists in 1974 and 1975. The cause of the rather sudden outbreak is unknown, but it is suspected that the increase in scale numbers was due to a decline in their natural enemies caused by drift from nearby aerial applications of insecticides for mosquito and crop insect control. These sprays are usually applied when the scale's natural enemies are more vulnerable than their host, thereby causing a sudden increase in scale productivity.

GENERAL INFORMATION

INSECT: Black pine-leaf scale, Aspidiotus californicus Coleman.

HOST TREE: Jeffrey pine, Pinus jeffreyi Grev. and Balf.

LOCATION: Genoa (Mormon Station), Nevada.

TYPE OF DAMAGE: Defoliation and killing of Jeffrey pine.

EXTENT OF DAMAGE: Approximately 120 acres immediately west of Genoa, extending from Genoa Canyon north to Sierra Canyon (see map).

BIOLOGICAL INFORMATION

The black pine-leaf scale attacks practically all pines in the United States, Canada and Mexico. The scale has three distinct life stages--egg, nymph, and adult. It has one to two generations per year, but this will depend on climatic variation. It is likely that in the Genoa area,

although not actually observed, the insect has two generations. If this is the case, then first generation eggs are deposited during late April or early May, and second generation eggs are laid sometime in July or August. Once hatched, the young nymphs (crawlers) wander about for a short period but eventually settle down by inserting their stylets (beaks) into the needles. Once established they lose their appendages and become stationary. They then cover themselves with a waxy substance which they continue to enlarge to accommodate their growth. The insects then overwinter under the protective scale coverings. Female scales outnumber the males ten to one, and their protective shell is more oval in shape.

Aerial reconnaissances of the infestation were made on September 25, 1974, and September 24, 1975. On-the-ground evaluations were made by entomologists William Klein on September 9 and Lawrence Stipe on November 21, 1975. During the afternoon of September 24, 1975, William Klein met with Nevada Division of Forestry Foresters Dale Saunders and Dave Frietas to examine the infestation firsthand. The discussion centered around the seriousness of the problem and the various control alternatives.

During both ground evaluation surveys, one lateral twig was removed by pole pruners from the lower half of 20 dominant or codominant Jeffrey pines throughout the infested area. The twigs were numbered, placed in individual paper bags and taken to the laboratory in Ogden for examination. Three new- and late-formed needles were removed from each of the 20 twigs collected on September 9, and three new-formed needles were removed from the November 21 sample.

At first glance, there appeared to be a preponderance of the older scales on the new-formed needles and a similar preference by the young scales for the late-formed growth. As a basis for further examinations, five needles from both groups were randomly selected, removed, examined under the microscope, and scale stages recorded. Once the preference was determined, with the object of determining natural mortality between the two collection dates, three needles from each group were removed from all 20 twigs, and all scale stages were counted in a one centimeter longitudinal section in the center of each needle.

The remaining infested needles from the November 21 collection were placed in finely screened ice cream cartons for rearing of parasites.

RESULTS

Table 1 shows that during the September 9 collection most of the older scales were found on the new-formed foliage, while the young, newly established scales were on the late-formed foliage (Figure 3). This suggests that the newly hatched crawlers settle on the newly developed foliage in the spring, and as foliage growth continues through the

summer, the scales mature, mate, lay eggs, and their progeny migrate to the late-developing growth of the same year. This indicates at least two generations each year.

Populations of the black pine-leaf scale on Jeffrey pine needles were exceptionally heavy during both sampling periods (Table 2) (Figure 3). Scale density averaged 33 per centimeter and although there was considerable variation within individual trees, the overall mean densities were identical, indicating no natural mortality during the two-month period.

Struble and Johnson (1964)^{1/} reported 20 to 30 scales per inch of needles length as being a high infestation level, and that prolonged infestation at these levels will eventually cause foliage loss. The Genoa infestation level is more than three times heavier than that reported by Struble and Johnson.

A cursory sample of radial increment borings taken from six heavily infested trees showed no noticeable growth loss during the past two years, but this is insufficient evidence. In some cases measurements of radial growth at d.b.h. do not reveal reduced increment; in others, reduced radial increment due to defoliation does not occur until one or two years following heavy defoliation.

Tree damage at this time includes reduced foliage length, branch kill and, to a lesser extent, tree mortality (Figures 4 and 5). Mortality appears to be widely scattered and limited to the smaller, partially suppressed trees.

DISCUSSION

If natural control factors do not intervene soon (there is no indication they will, at least not during the 1975-1976 season), the stand will experience heavy and permanent damage. Direct damage will be in the form of growth reduction, defoliation, branch kill and tree mortality. Indirect damage can result from the physiologically stressed trees falling prey to secondary bark beetles.

RECOMMENDATIONS

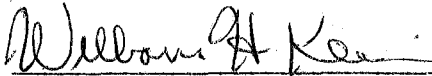
In the absence of effective natural control factors, the only practical and effective control strategy is chemical control. Treatment methods suggested are ground application (mistblower or hydraulic sprayer) of a

^{1/} Struble, George R. and Philip C. Johnson. 1964. Black Pine-Leaf Scale. USDA, Forest Service, Forest Pest Leaflet 91. 6 p.

dormant oil (Scalecide) during the dormant season or a chemical (Diazinon) directed against the crawler stage. Some control options and possible consequences follow:

1. Do nothing. In the absence of natural or applied control, many trees will experience forms of damage noted above, and some trees will die.
2. Limited control. This would be at the option of individual homeowners and would entail treatment of individual high-value trees. One or two annual reapplications may be necessary until the infestation subsides naturally.
3. Extensive Control. Treating most of the infestation at one time will protect most of stand, minimize the threat of scale invasion from nearby untreated trees and/or areas, and permit many of the most heavily damaged trees to recover. Since ground application equipment is required, it would be difficult to treat the entire area, particularly the western edge of the infestation.

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TABLE 1. COUNTS OF BLACK PINE-LEAF SCALE STAGES
ON OLD AND NEW 1975 FOLIAGE

Needle No.	Late-Formed Foliage			New-Formed Foliage		
	Length (cm.)	No. of Scales		Length (cm.)	No. of Scales	
		Mature	Young		Mature	Young
1	20.5	165	76	5	0	92
2	19.5	172	160	7	0	293
3	15.0	67	78	15.5	0	243
4	19.0	35	37	6.5	0	70
5	20.5	27	68	10.5	0	89
TOTALS	94.5	466	419	44.5	0	787
MEAN	--	4.9	4.4	--	0	17.7

TABLE 2. NUMBERS^{1/} OF BLACK PINE-LEAF SCALE ON
JEFFREY PINE PER CENTIMETER OF NEEDLE LENGTH,
GENOA, NEVADA, 1975.

Tree No.	September 9		November 21
	Late-Formed Needles	New-Formed Needles	New-Formed Needles
1	13	52	8
2	12	65	9
3	8	73	42
4	8	42	3
5	8	56	44
6	5	18	33
7	6	32	22
8	3	26	13
9	12	33	10
10	10	51	3
11	2	9	28
12	6	13	31
13	23	38	7
14	2	12	91
15	33	32	90
16	25	21	60
17	28	44	48
18	35	27	12
19	9	5	48
20	7	19	60
MEAN	13	33	33

^{1/} Average of three needles per tree.

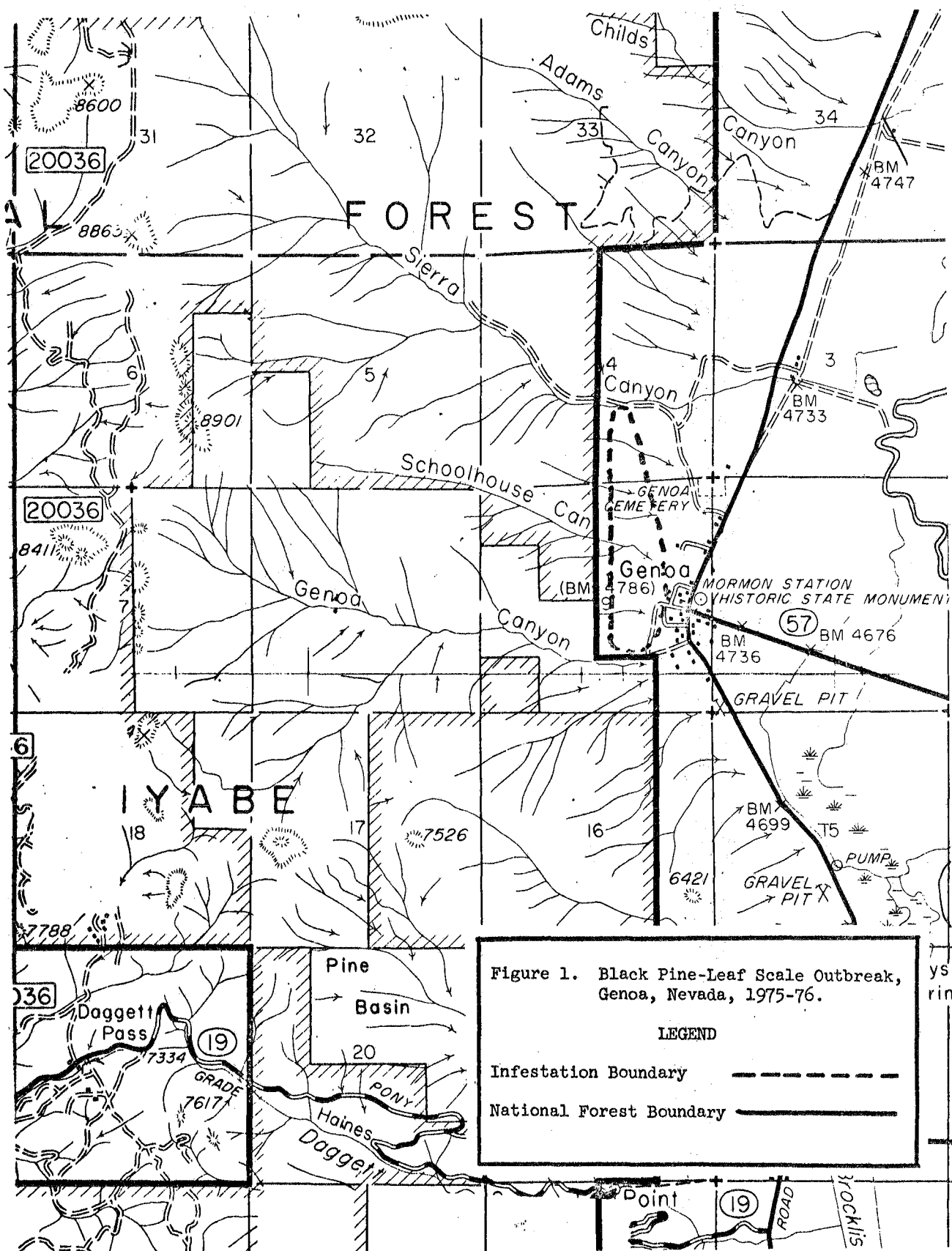


Figure 1. Black Pine-Leaf Scale Outbreak, Genoa, Nevada, 1975-76.



Figure 2. Aerial photograph of black pine-leaf scale infestation in Jeffrey pine; Genoa, Nevada, 1975.

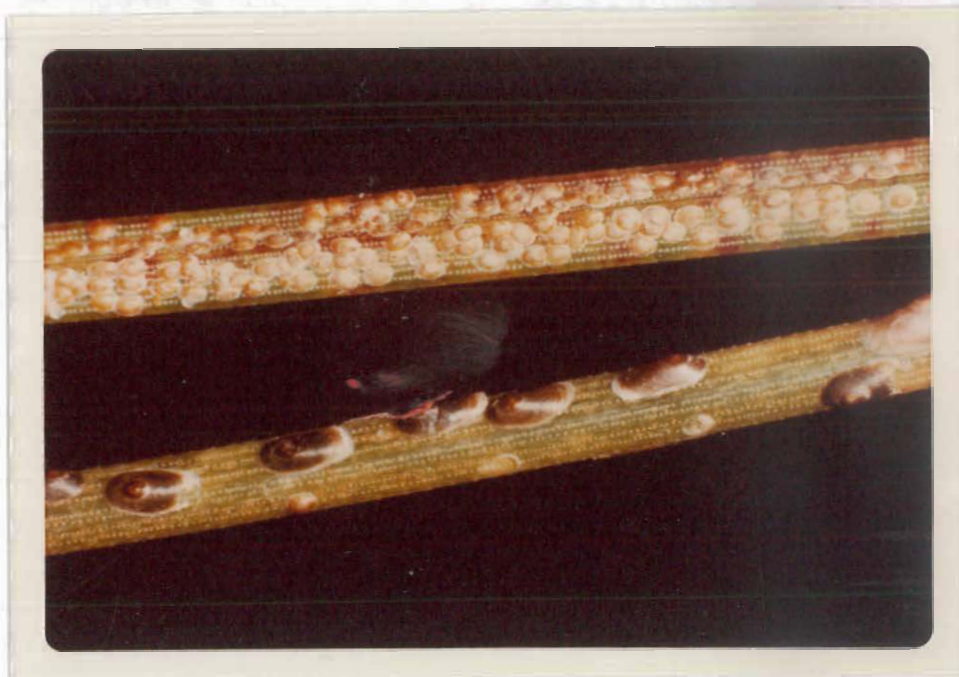


Figure 3. Young (top) and old (bottom) black pine-needlescales on Jeffrey pine needles.



Figure 4. Jeffrey pine twig infested with Black pine-leaf scale.



Figure 5.
Jeffrey pines
infested with
Black pine-
leaf scale.
The condomin-
ant tree
second from
left is dead.